Relative importance of price in forming individuals decisions towards sustainable food: a calibrated auction-conjoint experiment

Abstract

This paper explores the importance of pricing information in dealing with sustainable food preferences. It employs the Calibrated Auction-Conjoint Valuation Method (CACM), by comparing non-adjusted values from a self-explicated (hypothetical) conjoint method to the final calibrated values entered into an adjusted (real) auction. We found consumers significantly reduced their WTP when moving from the initial stage of the CACM (hypothetical self-explicated conjoint method) to the final stage (real auction), primarily by placing more importance on product prices, implying that WTP values from a self-explicated conjoint method used alone would likely lead to overstated estimates of WTP.

Keywords: Calibrated Auction-Conjoint Valuation, willingness-to-pay, sustainable farming, apples.

1. Introduction

During the last century European agriculture has intensified its production practices partially financed by the European Common Agricultural Policy (CAP) (Gardner, 1992 and 2002; Rude, 2001). This strategy responds to technological development incentives and profit maximization policies among other reasons, implying greater focus on continuous farming systems, increasing the use of farm inputs as well as irrigated lands or employing highly productive varieties. As a result, yields have been increased with some environmental side effects such as contamination of surface and ground water and loss of biodiversity due to the reduction of natural habitats, among other costs. These externalities arising from the intensification of conventional agriculture did have important effects on human health, animal welfare, and especially on the environment.

The growing interests of European consumers in the environmental effects of conventional agriculture have raised interest in sustainability (Chen, 2007). Consequently, consumers are increasing their interest towards alternative farming practices such as organic agriculture, placing sustainable agriculture as an interesting alternative for consumption (Chen, 2007). Consumer preferences for sustainability are related to how the goods are produced and how consumers value pollution emissions, use of chemical fertilizers, etc. (Hamilton and Zilberman, 2006).
Sustainable agriculture is often described as a food production system that causes less degradation of the ecological system compared to conventional production systems (Quenum, 2010). There are two main sustainable farming production systems:

integrated (IF) and organic farming (OF). See Table 1 for a summary of the main differences between conventional farming, IF and OF.

Table 1. Description of agricultural production systems

Systems	**Descriptions**
Conventional	In these production systems were promoted intensive irrigation systems in wide open plains, monoculture plantations and expensive external inputs. Although has a random control the conventional systems allow the use of fertilizers, pesticides and herbicides. No need an associated certification for the plant material and do not have any kind of certification. It allows the use of any postharvest treatment according to law. These systems not explicitly consider the environmental impact simply follow the existing general regulations.
Integrated	In these productions exists a mandatory control. It allows the use of fertilizers but differs from the conventional systems that the integrated systems enhances the applications of natural fertilizers and reduces the use of mineral and chemical synthesis fertilizers. Allows the use of pesticides (synthetic chemicals) as long as it is a rational application and the use of certain herbicides in some conditions. For both have to precede the biological methods than the chemical ones. A certification is needed for the plant material. The uses of postharvest treatments are authorized if they are technically justified. Priority is given to physical methods. Integrated systems have a certification and the produce respects the environment and minimizing environment impact.
Organic	The organic production has a mandatory control. It allows the uses of natural extractive mineral and organic fertilizers. The uses of mineral and chemical fertilizers are prohibited. The pesticides and herbicides (synthetic chemical products) are prohibited. For the plant material is necessary to use organic plant material certified or from authorized producers. The postharvest treatment is prohibited, unless they are natural like the use of hot water. All the products have a certification and the produce supports the biodiversity, respecting the environment and minimizing environmental impact.

Worldwide land devoted to OF has experienced a growth during the last decade. In late 2003, worldwide land devoted to organic agriculture was estimated at 26.5 million hectares, increasing in about 69% compared with 1998 (Mc Donald, 2001). In 2006, nearly 30.4 million hectares were devoted to OF, which constituted 0.65% of total agricultural land in the countries considered in the SOEL-FiBL survey (Foundation Ecology and Agriculture) - (Research Institute of Organic Agriculture). More recently, in the last survey realized by SOEL-FiBL, in 2011, it was reported that worldwide about

37.2 million of hectares were devoted to OF, which constitutes approximately a 0.9% of global agricultural land. In contrast, no international reliable data on IF is available since there not considered by any international or European regulation; therefore each member state has its own regulation, resulting in consequent differences among countries.

The geographical areas with larger amounts of land allocated to OF are Oceania, Europe and Latin America. Within Europe, Spain is the country with a higher number of hectares allocated to OF (Willer, 2011). In 2011, Spain had in 2011 1.85 million of hectares devoted to organic farming (67.7% was qualified as organic farming, 14.8% was qualified as “in conversion” to organic farming and the remaining 17.5% were qualified as “in the first year of practices”) (MAGRAMA, 2012). Unlike, In Spain there are just 803,408 hectares of IF (MAGRAMA, 2013). Therefore, there are few products in Spain produced simultaneously under Conventional, OF and IF. One of these are apples, covering 7% of Spanish total integrated area.

World production of apples, according to FAO statistics, achieved 71.2 million tons in 2009. China leads world’s apple production (44.4%), followed by United States (6.3%), Turkey (3.9 %), Poland (3.7%), Iran (3.4%) and Italy (3.2%). Only about 10.8% of world apple production is traded on international markets, and is controlled by six export countries: China, Chile, Italy, United States, Poland and France (FAO, 2010). Spain takes the place nineteen with 670,566 tons of exported apples (FAO, 2011). Consumption of apples in Spain is of 557, 26 million kilograms, that is about 12 kilograms of apples per person (MAGRAMA, 2010).

For the purpose of this research, we compare conventional, integrated and organic apple production systems to determine consumers' evaluations of, and WTP for, agro-ecosystems preservation. During the past decade, results from hypothetical valuation methods have been criticized because of the observation that consumers tend to overstate their WTP as compared to what happens in experiments with real economic incentives (e.g., List and Gallet, 2001). One of the most popular valuation methods is conjoint analysis (Green and Rao, 1971). However, conjoint methods typically do not offer immediate financial consequences. Another interesting method is the discrete choice method, widely used in previous research (Ding et al., 2005; Louviere and Street, 2000; Lusk and Shroeder, 2004, Janssen and Hamm, 2012). Discrete choice does allow a financial estimation but is often limited in the number of attributes that can be feasibly studied.

This study reports on an attempt to overcome both of these weaknesses of traditional valuation methods in an application involving a complex, multi-attribute good: agro ecosystem preservation. The present study utilized the Calibrated Auction-Conjoint Valuation Method (CACM) introduced by Norwood and Lusk (2011), to determine both consumer preferences for sustainable farming (organic and integrated versus conventional) and to understand the relative importance of price in forming individuals decisions towards sustainable food. Moreover, in addition to linking the auction bids with the conjoint rating to investigate consumer preferences for sustainable farming, we compare the non-adjusted values (obtained from the hypothetical self-explicated conjoint method) to the final calibrated values entered into an auction to explore the internal consistency of people's behaviors and the relevance of the price attribute versus agro-ecosystems preservation in the market for apples. This has not been done previously by Norwood and Lusk (2011) and therefore is a contribution of the present study to the literature. Therefore, the paper contribution deals with both empirical findings on consumers' behavior toward sustainable produced food and method testing.

The next section outlines the methodological framework. Section 3 is devoted to the description of the methods, data, and analytical procedures. The fourth section reports the results. Section five contains the concluding remarks.

2. Background

Incentive-compatible elicitation mechanisms can be categorized into two general categories: experimental auctions and non-hypothetical discrete choice experiments (Corrigan et al., 2009; Lusk and Shogren, 2007; Lusk and Schroeder, 2004). One of the main advantages of experimental auctions is that they place subjects in an active market environment where they can learn and adjust to market conditions. In addition, bids provide researchers an explicit estimate for each participant's WTP without the need to estimate an econometric model. Non-hypothetical choice experiments incorporate incentives into the traditional conjoint method by randomly selecting one of the several repeated choices between competing product profiles as the binding. The participant purchases the product indicated as most preferred in the randomly selected choice set (Alfnes et al., 2006; Carlsson and Martinsson, 2001; Ding, et al., 2005; Ding, 2007; Lusk and Schoroeder, 2004; Lusk et al., 2008; Janssen and Hamm 2012).

The upside of non-hypothetical choice experiments is that they are easy for people to answer, being more similar to the choices people make in the marketplace. The downside is that choice experiments can require sophisticated experimental designs and econometric estimates to derive WTP estimates. Recently, Norwood and Lusk (2011) suggested an approach combining the strengths of conjoint and auction elicitation methods in a procedure that promotes systematic and rational behavior; they referred to the approach as the Calibrated Auction Conjoint valuation Method (CACM).

With the CACM, people calibrate their attribute-based utility functions to produce the auction bids they desire. The CACM has several advantages over existing valuation approaches. First, it imposes a mechanical or algebraic relationship between valuations and utility by linking auction bids with conjoint ratings and an underlying utility function which generates consistent and systematic responses. Second, the CACM is an iterative valuation process that promotes learning and provides feedback, helping subjects to form rational preferences. Third, it allows for a distribution-free characterization of heterogeneity regarding preferences. Finally, the CACM allows for the evaluation of a large number of attributes and attribute-levels while enabling the estimation of people's values for a very large number of products (see Norwood and Lusk, 2011).

3. Methods, data and analytical procedure

3.1. The data

The data used in this study were collected by means of a two-step experiment: a first part dealing with a hypothetical exercise and a second part with real economic incentives. To perform the experiment, a specific software program was developed using Visual Basic. A sample of consumers from Barcelona (Spain) was recruited by a marketing research company for the purpose of this study. Participants were recruited by phone to participate in an “apple preference study” and were promised 20€ for their participation. The selection of apples as the product of study responds to the aim of valuing the behavior towards a fresh product. In addition, apples are commonly consumed by the general public and of easy conservation. The last reason is that there are few products in Spain produced under the three systems of interest of this research. Eight sessions of 10 participants each were conducted in March 2010. The main socio-demographic characteristics of the sample are shown in Table 2. The sample was made up of 40% men and 60% women. Almost 70% of the respondents were between 35 and 65 years old. As expected, the majority of the sample (more than 80%) had finished secondary school and had a medium household income level (from 1000 to 5000 €/month family).

Table 2.Demographic distribution of the sample

Demographic	N = 80	%	Official Population distribution*
Gender			
Female	48	60	51
Male	32	40	49
Age in years			
18-34	23	29	30
35-49	32	40	29
50-64	23	29	21
65 or older	2	2	20
Education			
Primary school unfinished	1	1	12
Primary school finished	4	5	26
Secondary school unfinished	6	8	25
Secondary school finished	40	50	23
University degree	25	31	14
Post graduated degree	4	5	
Income in Euros			
1000 or less	5	6	No available data
1001-2000	28	35	
2001-3000	26	32	
3001-5000	15	19	

5001 or more	6	8

*IDESCAT 2009

3.2. Experiment design

The CACM works as follows. First, participants answer a series of simple rating questions where they indicate the relative desirability of different product attributes and the associated levels of each attribute. This step uses the so-called self-explicated conjoint approach and can accommodate a large number of attributes and attribute levels, as the analyst is not required to use a specific experimental design. Second, a computer takes the ratings to construct a utility function for specific products as defined by the underlying attributes, and calculates each respondent's WTP for the products relative to the valuation of a base level. Up to this point the method works as a hypothetical experiment. Third, the calculated WTP values are shown to participants and they are told that from now on the experiment will be real and, therefore, are asked to return to step 2 to readjust (or calibrate) their ratings (and indirectly the utility function) if they wish to change their WTP. Finally, once subjects are settled on their WTP values, they are entered as bids into an incentive-compatible experimental auction.

The experiment was conducted in two stages[1]: 1) welcome and introduction to the experiment and 2) the CACM. During the introductory stage, each respondent was seated in a cubicle with a computer. Then, a brief explanation of the experiment objectives and confidentiality of the data was provided.

The second stage of the experiment consisted of the CACM. Following Norwood and Lusk (2011), respondents were first asked to rank their preference for different characteristics associated with three different production systems (organic, integrated

[1] First of all, a pilot experiment was conducted. Its aim was to test both the "software" developed for the CACM experiment and the methodology that would be used for the auction. A total of 10 participants (students and colleagues) were employed.

and conventional production). To select and define the attributes associated with the different production systems, a focus group[2] with experts was previously conducted by the research team. The focus group was integrated by three technical experts, two professors of agriculture and two farmers of organic food.

The selected attributes were price, environmental impact, the use of fertilizers, pesticides and herbicides, plant material, post-harvest treatments, and certification (see Table 3 for a description of the attributes and levels as they were delivered to the respondents). Before starting this stage of the experiment (hypothetical exercise), a cheap-talk script (Cummings and Taylor, 1999) was introduced in order to reduce respondents' WTP in hypothetical experiments. Finally, we asked consumers to be careful and think about their answers.

Collection of data for the CACM proceeded in four steps[3] : *Step 1:* Participants were shown numerous tables on the computer screen that corresponded to each of the attributes studied. In each table, the respondents were asked to rate the desirability of each attribute-level on a 1 to 10 scale, where 1 was very undesirable and 10 was very desirable. In each case, and previous to the participant's evaluation, a full description of each attribute level was presented[4] (See Figure 1 as an example).

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[2]" carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment" (Krueger and Casey, 2000, p. 5)

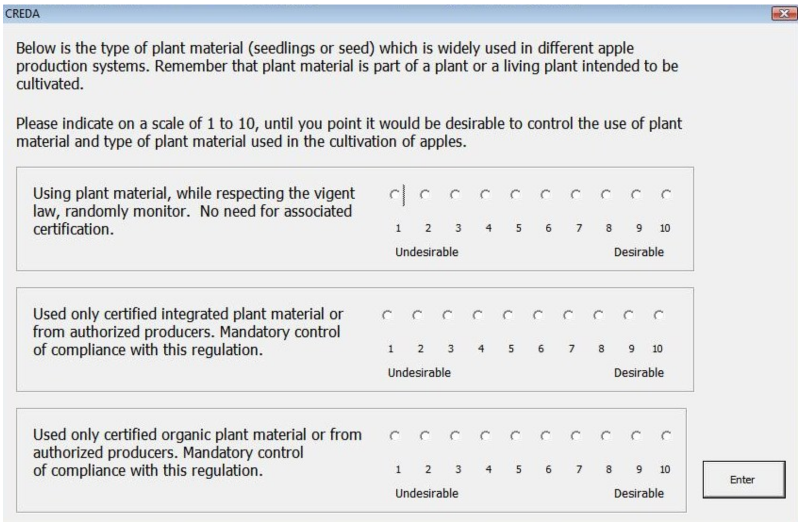
[3] The whole experiment was not explained to respondents at the beginning of the experiment. We did explain the experiment step by step.

[4] The CACM design in this study does not accommodate non-compensatory decision rules. However, this could be easily taken into account following Srinivasan and Park (1987) by add a simple check-box allowing consumers to indicate they wouldn't pick a product with that attribute not matter how attractive were all the other attributes. In any case, if someone has non-compensatory preferences, it would imply they would be willing-to-pay exactly zero for alternatives that had attributes with the completely undesirable level. As we show latter, however, we did not observe any zero WTP values, suggesting this is not a problem in our particular study.

Table 3.Attributes levels

Attributes	**Level 1** *Conventional System*	**Level 2** *Integrated System*	**Level 3** *Organic System*
A1 ***Fertilizers***	Random control It allows the use of three types of fertilizers (mineral chemical synthesis, organic and natural minerals)	Mandatory control It allows the use of three types of fertilizers. The obligatory control enhances the application of natural fertilizers and reduces the use of mineral and chemical synthesis fertilizers.	Mandatory control. The use of mineral and chemical synthesis fertilizers is prohibited. It allows the use of natural extractive mineral fertilizers and organic fertilizers
A2 ***Pesticides***	Random control Allows the use of synthetic chemicals.	Mandatory control Allows the use of synthetic chemicals, as long as it is a rational application. Have to precede the biological, biotechnological, cultural, physical and genetic methods to the chemicals methods.	Mandatory control The use of synthetic chemicals products is prohibited.
A3 ***Herbicides***	Random control It allows the use of herbicides	Mandatory control Only allows the use of certain herbicides in some conditions. Have to precede the biological, biotechnological, cultural, physical and genetic methods to chemical methods.	Mandatory control The use of herbicides is prohibited.
A4 ***Plant material***	Random control Using plant material, while respecting the law. No need for associated certification.	Mandatory control Used only certified integrated plant material or from authorized producers.	Mandatory control Used only certified organic plant material or from authorized producers.
A5 ***Postharvest treatment***	Random control It allows the use of any post harvest treatment according to law.	Mandatory control Only allows the use of post harvest treatments authorized by law if they are technically justified. Priority is given to physical methods or natural products to synthetic chemical products.	Mandatory control. Prohibited unless they are natural products (eg hot water).
A6 ***Certification***	There are not certification	Integrated production certification.	Organic certification production
A7 ***Environmental impact***	Not explicitly consider the environmental impact. Simply follow the existing general regulation.	Produce, respecting the environment and minimizing environmental impact.	Produce supporting biodiversity, respecting the environment and minimizing environmental impact.

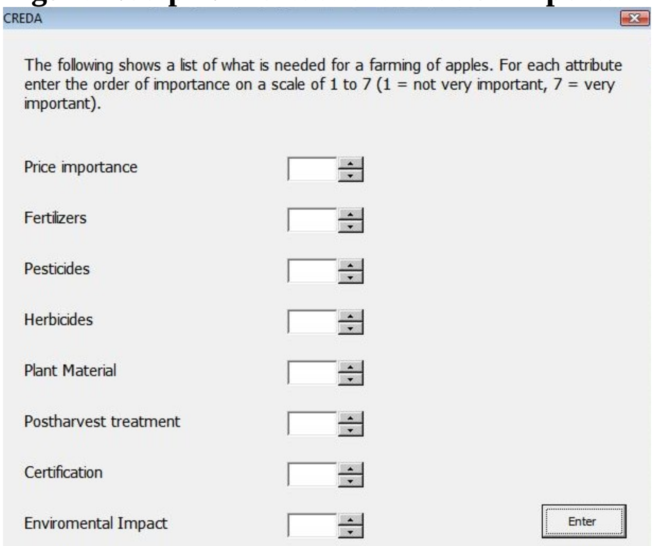
Figure 1.Step 1: Rate the desirability of attributes levels



Step 2: Participants were asked to indicate the relative importance of each attribute when purchasing apples on a 1 to 7 scale, where 1 was very unimportant and 7 was very important (see Figure 2). Respondents were encouraged to think about the relative importance.

The first two steps mirror the approach used in self-explicated conjoint studies (see Srinivasan and Park, 1997).

Figure 2.Step 2: Indicate the relative importance of each attribute



Step 3: The next step of the CACM consisted of an auction[5]. The bids were calculated using the data collected in steps 1 and 2, and the subjects were told that their bids should be adjusted to reflect the highest amount of money that they were willing to pay for one kilo of each of the three different kinds of apples.

Participants were asked to bid for a kilo of conventional apples (this was not a prediction from the CACM)[6]. Following Norwood and Lusk (2011), a bid was forecasted for two other products (organic and integrated) using each person's previous responses to the ranking questions in steps 1 and 2. Each individual's relative WTP for each apple product is derived from the difference in utilities between two alternatives divided by the marginal utility of income, following Norwood and Lusk (2011). The alternatives entailing each production system (conventional, organic and integrated) differ in their attribute levels as presented in Table 3.

First, individual *i*'s attribute-based utility for a kilogram of each apple type *j* (Z_{ij}) was calculated by multiplying the relative importance of each attribute, using data obtained from stages 1 and 2 of the CACM as follows:

$$Z_{ij} = \sum_{k=1}^{K} \sum_{l=1}^{L_k} W_{kl}(I_k R_{kl}) \quad (1)$$

where I_k represents the stated importance of the k^{th} attribute normalized so as $\Sigma I_k = 1$ (selected by respondents in step 2; Figure2). Furthermore, R_{kl} represents the rating of the l^{th} of the k^{th} attribute, normalized so that the lowest rated level of each attribute has a scaled rating of 0 and the highest rated level of each attribute has a scaled rating of 1

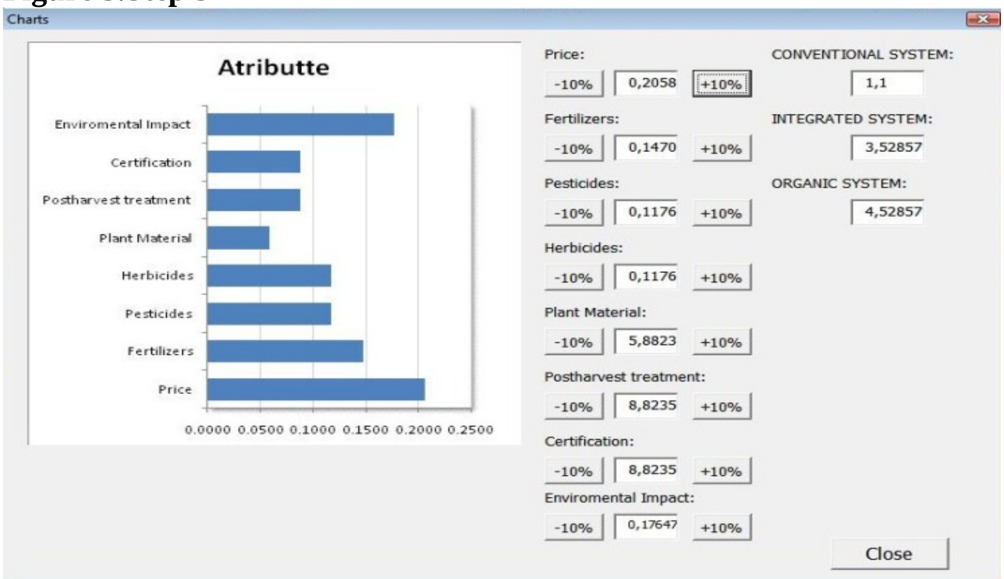
[5] People were trained on the use of the bidding procedures. Consumers participated in an auction for a mineral water 33cl bottle to become familiarized with the procedures. The mineral water auction was designed to mimic the apple auctions to facilitate the learning process.

[6] We need this value because the utility model only gives us differences in utility instead of total values.

(selected by respondents in step 1; Figure1). L_k is the number of levels over which the k^{th} attribute is varied, *K* is the number of attributes. W_{kl} is a dummy variable that equals to 1 if apple product *j* processes the l^{th} level of the k^{th} attribute, and 0 if otherwise. The term $I_k R_{kl}$ can be interpreted as a utility "part-worth," which is the utility provided from the l^{th} level of the k^{th} attribute. This part-worth is analogous to the coefficients in a random utility model estimated from a conjoint analysis, with W_{kl} being the explanatory variable for presence or absence in the conjoint analysis.

Lastly, the willingness-to-pay to purchase one product (*j*) versus another (product *t*) was calculated by dividing non-price utility differences between the products (equation 1) by the "part-worth" on price, which represents the marginal utility of income $WTP_{ij} - WTP_{it} = \frac{Z_{ij} - Z_{it}}{I_{iP}}$ where I_{iP} is the normalized price attribute (Norwood and Lusk, 2011)[7]. The forecasted bids were shown to people together with the relative importance of each attribute level by means of a bar chart (see Figure 3).

Figure 3.Step 3



[7] Price trade-off is calculated using person's utility function and no interpersonal comparisons are made.

An E-02 must be added to the numerical values for plant material, post-harvest treatment and certification. It was not shown in Figure 3 due to the format of the resulting box. Respondents were informed about this issue during the experiment.

Of course, the forecasted WTP values may differ from what people are actually willing to pay.

Step 4: At the last step of the CACM consumers were told that the winner of the auction would have to pay for the kilo of apples that would be selected. However, the only way for people to change their bids was to go back and change the relative importance of the attributes provided in step 2. This step forces an internal consistency between economic valuations and the underlying utility function that maps preferences for agricultural production attributes to the apples produced under different conditions.

Participants had the opportunity to change the relative importance of each product attribute by means of a drop-down box. Simultaneous with the adjustment of the attribute importance, people could see how their bids changed for the three types of apples as their ratings changed. It‘s important to highlight that respondents don not only notice about the change in the bids but also in the relative importance of the different attributers by means of a bar chart as presented in Figure 3. Once the participants were satisfied with their bids, they hit the submit button. The final bids appeared on the screen. One production system (i.e., conventional, organic or integrated) was randomly selected. The highest bidder for the chosen type of apples was announced as the winner of the auction. (S)he took the chosen apples home after paying the second highest bid.

Our computer program kept track of subject’s initial ratings in steps 1, 2 and 3. These are the data that a marketing analyst would normally use to compute subjects’ WTP and market share. However, these reflect the subjects’ ratings before knowing that the submitted bids would subsequently be entered into an auction and therefore would have to pay for them. By comparing the implied WTP values that resulted after subjects first completed steps 1, 2 and 3 to the final submitted bids, we can determine the effect of the CACM procedure (and the move from non-adjusted to real (adjusted) economic environments) on consumers' valuations.

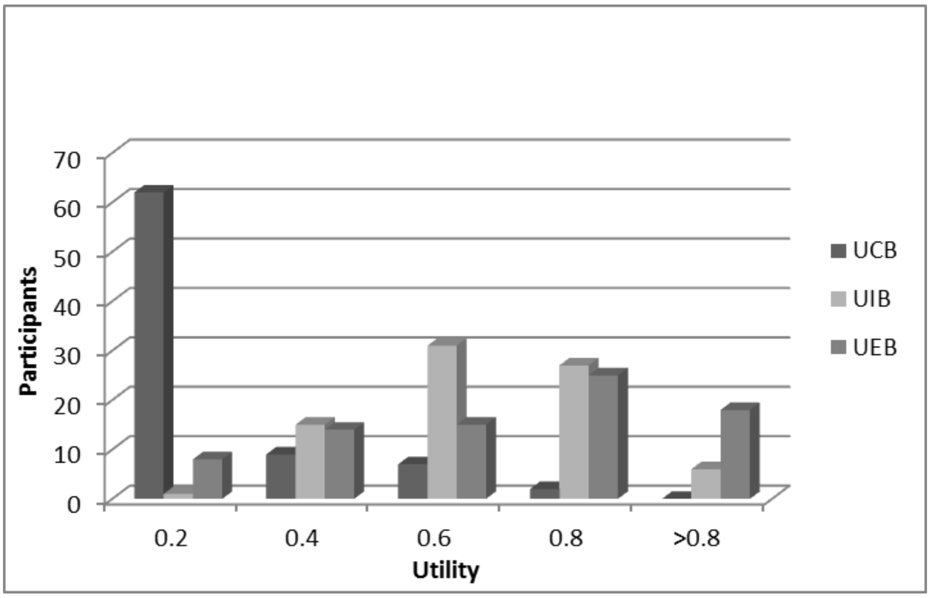
4. Results

Table 4 and figures 4 and 5 presents the main statistics associated to the utility part-worth before and after the adjustment. The average utility for the conventional production system is 0.1217. This value increased to 0.5461 for integrated apples and to 0.5777 for organic apples. It is interesting to see that after adjustment, the average utility for integrated and organic apples decreases to 0.4398 and 0.4635 respectively. These results illustrated that participants positively value environmentally friendly production systems and especially organic products. This can be explained because the certification and legislation associated to organic production is well known among consumers while for the case of integrated production they are at the earlier stages and, consequently, more unknown to consumers.

Table4. Utility part-worth statistics.

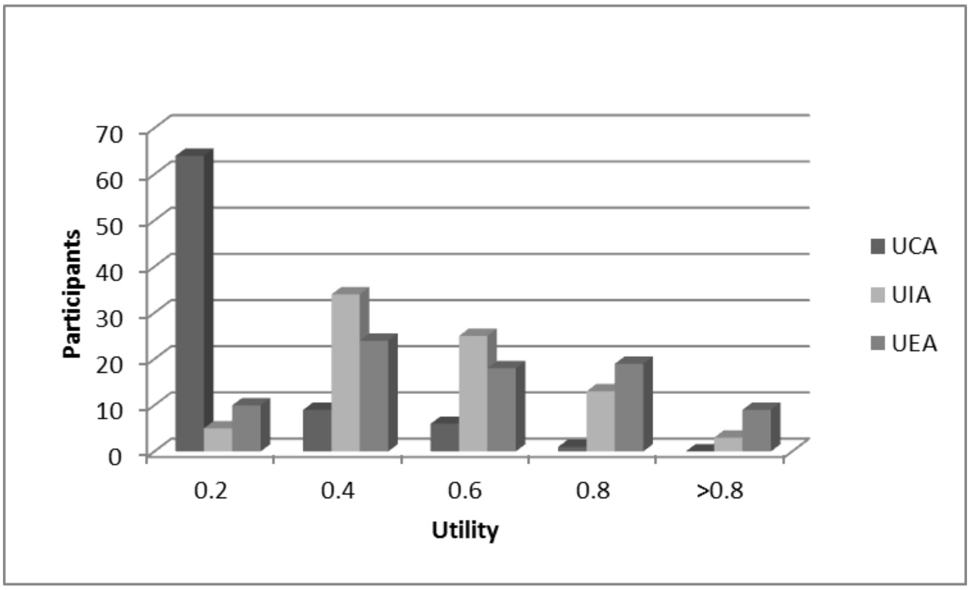
	BEFORE ADJUSTMENT			AFTER ADJUSTMENT		
	Conventional Utility	**Integrated Conventional**	**Organic Utility**	**Conventional Utility**	**Integrated Conventional**	**Organic Utility**
Min	0	0.1047	0	0	0.0828	0
Mean	0.1217	0.5461	0.5755	0.1217	0.4398	0.4635
S. Error	0.0198	0.0189	0.0291	0.0198	0.0199	0.0270
S. Desv.	0.1775	0.1686	0.2603	0.1775	0.1781	0.2420
Median	0.0169	0.523	0.6151	0.0169	0.4101	0.4327
Max	0.6806	0.9167	0.9744	0.6806	0.8573	0.8974

Figure4. Utility distribution before the adjustment



Note: UCB (conventional apples utility); UIB (integrated apples utility); UEB (organic apples utility).

Figure5. Utility distribution after the adjustment



Note: UCA (conventional apples utility); UIA (integrated apples utility); UEA (organic apples utility).

The bids from the CACM are shown in Table 5. Before the adjustment, the average bid for a kilogram of apples from the conventional production system was 1.15€. This value increased to 3.65€ for apples from integrated production systems and to 4.14€ for apples from organic production systems. It is interesting to see that after the adjustment, the value for the apples from the integrated production systems was of 2.76€. This finding implies a decrease of 24% compared to the initial case. Furthermore, the average bid for apples from organic production systems was 3.15€, which was 0.99€ less than the initial non-adjusted bid. Tables 6 and 7 show that

WTP values are statistically different from one another considering the differences before and after the adjustment as well as the differences among production systems (conventional vs. organic vs. integrated)

Table 5. Distribution of the bids (Euros)

	Conventional	Integrated	Organic
Before the adjustment			
Minimum	0.30	0.71	0.67
Median	1.00	3.65	3.90
Mean	1.15	3.65	4.14
Max	2.50	6.87	10.00
Standard deviation	0.46	1.59	2.20
After the adjustment			
Minimum	0.30	0.36	0.67
Median	1.00	2.36	2.67
Mean	1.15	2.76	3.15
Max	2.50	6.61	9.30
Standard deviation	0.46	1.53	1.85

Table 6. WTP differences before and after adjustment

Apple	t	P
Integrated	6.16	0.000*
Organic	6.43	0.000*

*P≤0.01

Table 7. WTP differences between production systems before and after adjustment

Apple	Before adjustment		After adjustment	
	t	P	t	p
Conventional/Integrated	-14.44	0.000*	-9.65	0.000*
Conventional/Organic	-12.03	0.000*	-9.61	0.000*
Integrated/Organic	-2.51	0.014**	-2.23	0.029**

*P≤0.01; **P<0.05

These results suggest that participants positively value sustainable agriculture such as organic and integrated systems versus conventional one, illustrating the potential market for organic and integrated foods in Spain. However, this market probably requires better designed pricing and promotional strategies to inform consumers about the positive effects of such products on the environment and needs to take into account the real WTP. Additionally, results show that participants' revealed a higher WTP for organic and integrated apples in non-adjusted than in adjusted settings. These results are consistent with findings by List and Gallet (2001) and Lusk and Schroeder (2004). In our case, the non-adjusted bias resulted primarily from the relative priority to price.

Figure 6 illustrates the differences between the WTP for the initial non-adjusted and the calibrated bids for a kilogram of both organic and integrated apples. We can see that about a 30% (33%) of respondents did not change their WTP for organic (integrated) apples, while for another 31% (28%) WTP changes were lower than 1 Euro. On the opposite side, around 10 % of participants adjusted their WTP for more than 5 Euros.

It's interesting to say that more than 70% of participants decreased their bids, while more than 20% of respondents kept their bids invariant for both organic and integrated apples. Just around a 5% of participants did increase their bids after the adjustment (see Figures 7 and 8).

Figure 6. WTP differences between non-adjusted (initial) and calibrated bids for organic and integrated apples

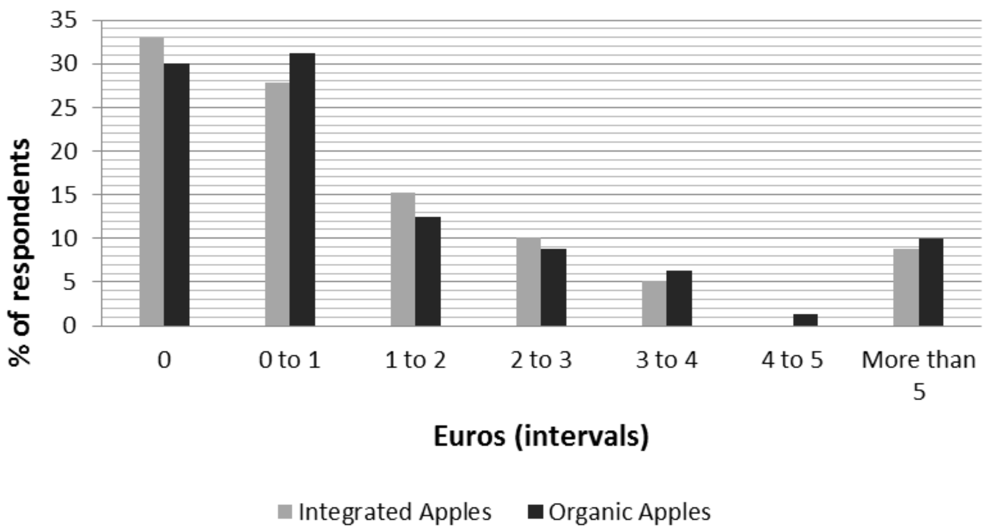


Figure 7. Bid adjustment for integrated apples

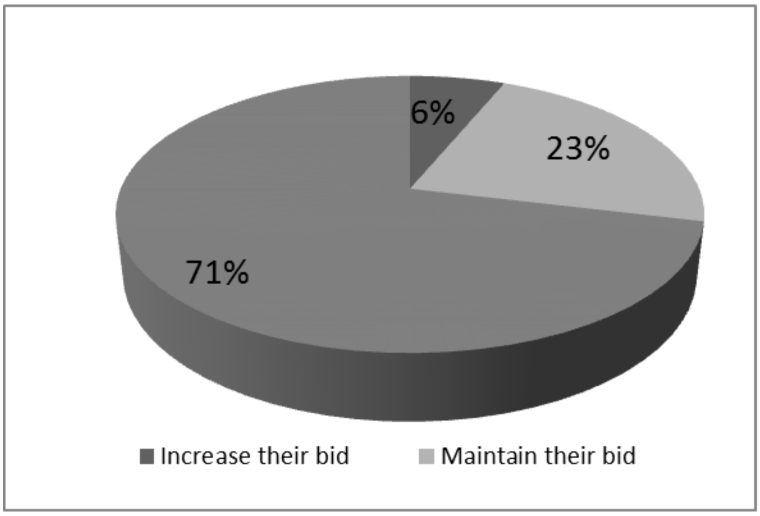
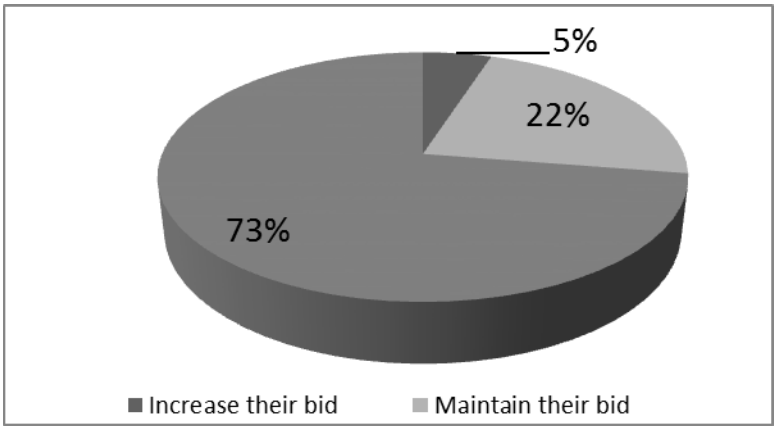


Figure 8. Bid adjustments for organic apples



To deeply analyze the differences between the non-adjusted and adjusted bids, Figures 9 and 10 show respondents' average rankings of the relative importance of the attributes associated to the production systems both before and after adjustments. As expected, the most important attribute was price[8]. However, it can be observed that the environmental protection attribute was also very important for the sample, followed by the use of pesticides. The rest of the attributes were considered as equally important. It must also be highlighted that after the adjustment, price relevance increased in about 16 percentage points. However, it is interesting to observe that when respondents modified

[8] During the survey, consumers were asked about the role of price in their decisions when purchasing organic food. More than 81% of consumers placed high importance either on questions about price, price comparison or promotions. (At the time of shopping I compare the prices of possible alternatives; I pay attention to offers when I buy food; at the time of buying a product its price is very important to me.)

the relative importance of the rest of the attributes to increase the importance of price, they maintained almost the same ranking order as they revealed in the hypothetical experiment, which validates the rationality of their first step responses. In order to clarify the validity of the recalibration we have performed a paired t-test in order to compare the attributes means before and after the adjustment (see Table 8). Results suggest that the means for all the attributes are significantly different before and after adjustments, which leads us to conclude that all the attributes were indeed modified.

Fig. 9 Relative Importance of Attributes (before adjustment)

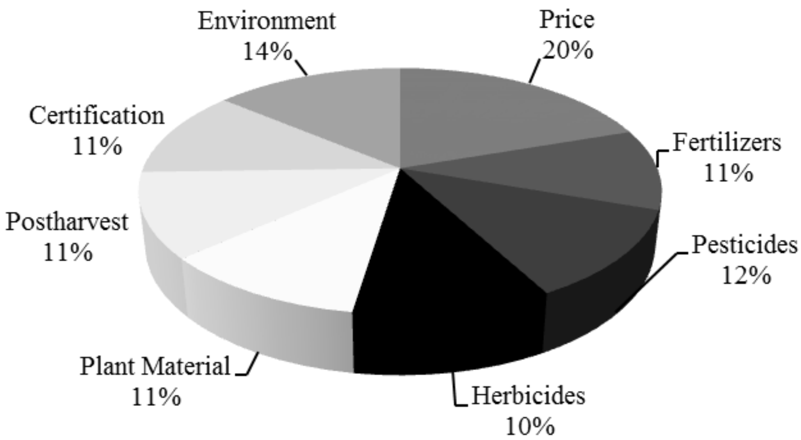


Fig. 10 Relative Importance of Attributes (after the adjustment)

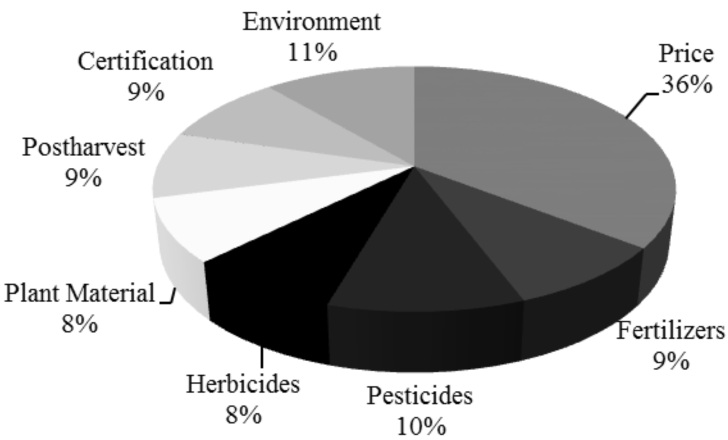


Table 8. Attributes recalibration validity

Variable	CI	T	P
Price	(-0.2115, -0.0982)	-7.22	0
Fertilizers	(0.00807, 0.3241)	4.39	0
Pesticides	(0.00138, 0.03338)	2.87	0.005
Herbicides	(0.01036,0.03119)	5.27	0
Plant Material	(0.01378, 0.03899)	5.53	0
Postharvest treatment	(0.00872, 0.03768)	4.23	0
Certification	(0.00549, 0.03332)	3.68	0
Environmental Impact	(0.000467, 0.05023)	3.18	0.002

Table 9 shows the average WTP for selected changes in all attribute levels for apples, or the WTP for shifting from one level (representing a specific production system) on each attribute to another level of the same attribute (representing another production system). The results are presented for the two bids (non-adjusted and adjusted). We can observe a positive WTP in shifting from conventional production to organic or integrated production for all attributes in both settings previous and after the adjustment. However, no significant differences can be observed if we compare the two sustainable production systems. It's important to emphasize the decrease in the WTP when comparing the adjusted from the non adjusted bids. This indicates that in the first stage of the experiment, hypothetical bids, participants overstate the desirability of the attributes.

Table 9. WTP Values for Selected Changes in attribute levels corresponding to each production system (Euros).

	Non adjusted Bid	Adjusted Bid
Fertilizers		
The use of mineral and chemical synthesis fertilizers is prohibited (organic) vs It allows the use of three types of fertilizers (conventional).	0.34*	0.19*
The obligatory control enhances the application of natural fertilizers and reduces the use of chemical synthesis fertilizers (integrated) vs It allows the use of three types of fertilizers (conventional).	0.27*	0.15*
The use of mineral and chemical synthesis fertilizers is prohibited (organic) vs. The obligatory control enhances the application of natural fertilizers and reduces the use of chemical synthesis fertilizers (integrated).	0.06	0.04
Pesticides		

The use of synthetic chemicals product is prohibited (organic) vs Allows the use of synthetic chemicals (conventional).	0.41*	0.22*
Allows the use of synthetic chemicals, as long as it is a rational application (integrated) vs Allows the use of synthetic chemicals (conventional).	0.33*	0.18*
The use of synthetic chemicals products is prohibited (organic) vs Allows the use of synthetic chemicals, as long as it is a rational application (integrated).	0.08	0.04
Herbicides		
The use of herbicides is prohibited (organic) vs It allows the use of herbicides (conventional).	0.37*	0.15*
Only allows the use of certain herbicides in some conditions (integrated) vs It allows the use of herbicides (conventional).	0.29*	0.12*
The use of herbicides is prohibited (organic) vs Only allows the use of certain herbicides in some conditions (integrated).	0.07	0.04
Plant Material		
Used only certified organic plant material (organic) vs No need for associated certification (conventional).	0.37*	0.17*
Used only certified integrated plant material (integrated) vs No need for associated certification (conventional).	0.32*	0.14*
Used only certified organic plant material (organic) vs Used only certified integrated plant material (integrated).	0.05	0.02
Postharvest treatment		
Prohibited unless they are natural products (organic) vs It allows the use of any post harvest treatment according to law (conventional).	0.37*	0.17*
Only allows the use of post harvest treatments authorized by law if they are technically justified (integrated) vs It allows the use of any post harvest treatment according to law (conventional).	0.32*	0.15*
Prohibited unless they are natural products (organic) vs Only allows the use of post harvest treatments authorized by law if they are technically justified (integrated).	0.05	0.02
Certification		
Organic certification production (organic) vs There are not certification (conventional).	0.38*	0.21*
Integrated production certification (integrated) vs There are not certification (conventional).	0.32*	0.16*
Organic certification production (organic) vs Integrated production certification(integrated).	0.06	0.05
Environmental Impact		
Produce supporting biodiversity, respecting the environment (organic) vs Not explicitly consider the environmental impact (conventional).	0.46*	0.26*
Produce, respecting the environment (integrated) vs Not explicitly consider the environmental impact (conventional).	0.38*	0.22*
Produce supporting biodiversity, respecting the environment (organic) vs Produce, respecting the environment (integrated).	0.08	0.04

*Significant differences

5. Conclusions

Our results show that people's valuations of apples are affected by the production system and that Spanish respondents place a higher value on organic products in comparison to ones obtained from integrated or conventional production systems. However, among a set of attributes associated with a production system (e.g., price; environmental impact; the use of fertilizers, pesticides and herbicides; plant material; post-harvest treatments; and certification), price had a higher relative importance, followed by the environmental impact of the production system.

This study compared a non-adjusted (hypothetical self-explicated) conjoint valuation experiment and an incentive compatible calibrate experiment using the Calibrated Auction – Conjoint Valuation Method proposed by Norwood and Lusk (2011). On average, respondents were willing to pay 1.15, 3.65 and 4.14 Euros for a kilogram of conventional, integrated and organic apples, respectively, for the non-adjusted (hypothetic) bid. For the incentive-compatible experiment, the biding decreased to 2.76 and 3.15 Euros for a kilogram of integrated and organic apples. It is important to highlight that when respondents decreased their WTP due to the introduction of monetary incentives, this was done in a rational way or that the relative importance of the other attributes was maintained in the same relative proportion as was done in the first bidding.

Therefore, we can conclude first that price does have a relevant role on defining consumers' WTP sustainable food and therefore the market for organic and integrated food may have to better adjust its price in order to reach wide-ranging consumers. Second, we noticed that there is a lack of information among Spanish consumers regarding to integrated production. This result is in line with Janssen and Hamm (2012) who emphasized the necessity of increasing consumer awareness of the organic logo to have an effect of their perceptions and attitudes towards certified food. Finally, we can state that a self-explicated conjoint method used alone would likely lead to overstated estimates of WTP and that the CACM methodology allows respondents to develop a rational behavior in the bidding experiment.

Furthermore, it will be interesting for future research to explore if the order of bids matters. That is, if we will obtain the same results if the elicitation bids are done for the organic products and the forecasted for conventional and integrated ones.

References

Alfnes, F., A. G.Guttomsen, G. Steine and K. Kolstand (2006) Consumers' Willingness to Pay fo the Color of Salmon: A Choice Experiment with Real Economic Incentives. American Journal of Agricultural Economics 88: 1050-61.

Carlsson, F., and P. Martinsson (2001) Do Hypothetical and Actual Maginal Willingness to Pay Differ in Choice Experiments? Journal of Environmental Economics and Management41 (2): 179-92.

Chen, M. (2007) Consumer attitudes and purchase intentions in relation to organic foods in Taiwan: Moderating effects of food-related personality trails. Food Quality and Preference18 (7): 1008-1021.

Corrigan, J. R., Dinah P.T., Rodolfo M. N., Ximing, W., and Tiffany, P. L. (2009) Comparing open-ended choice experiments and experimental auctions: An apllication to golden rice. American Journal of Agricultural Economic 91 (3): 837-853.

Cummings, R.G., Taylor L.O. (1999) Unbiased value estimates for environmental goods: a cheap talk design for the contingent valuation method. American Economic Review 89 (3): 649–665

Ding, M. (2007) An Incentive-Aligned Mechanism for Conjoint Analysis. Journal of Marketing Research 44: 214-23.

Ding, M., R. Grewal, and J. Liechty (2005) Incentive-Aligned Conjoint Analysis. Journal of Marketing Research 42 (1): 67-83.

Gardner, B. L. (2002). American agriculture in the twentieth century: how it Flourishe and what it cost. London: Harvard University Press.

Gardner, B. L. (1992). Changing economic perspectives on the farm problem. Journal of Economic Literature 30, 62-101

Green, P. E. and V. R. Rao. (1971). Conjoint Measurement for Quantifying Judgmental Data. Journal of Marketing Research 8 (3): 355-63.

Meike Janssen, Ulrich Hamm. (212) Product labelling in the market for organic food: Consumer preferences and willingness-to-pay for different organic certification logos, Food Quality and Preference, 25, 1, 9-22

Hamilton, F. and D. Zilberman. (2006). Green markets, eco-certification, and equilibrium fraud. Journal of Environmental Economics and Management 52: 627-644.

List, J. A. and C. A. Gallet. (2001). What Experimental Protocol Influencce Disparities Between Actual and Hypothetical Stated Values? Environmental and Resource Economics 20: 241-54.

Lusk, J. L. and T. C. Schroeder. (2004). Are Choice Experiments Incentiva Compatible? A Test With quality differentiated beef steaks. American Journal of Agricultural Economics 86 (2): 467-482.

Louviere, J.J. & Street, D. (2000). Stated-preference Methods' in David A Hensher & Kenneth J Button (eds), Handbook of Transport Modelling, Pergamon Press, Amsterdam, Netherlands, pp. 131-143.

Lusk, J. L., D. Fields, and W. Prevatt. (2008). An incentive Compatible Conjoint Ranking. American Journal of Argricultura Economics 90 (2): 487-98.

Lusk, J.L. and J. Shogren. (2007). Experimental Auctions: Methods and Aplicattion in Economic and Marketing Research. Cambridg, U.K.: Cambridge University Press.

MAGRAMA. 2012. Ministerio de Agricultura, Alimentación y Medio Ambiente. Organic agriculture statistics 2011. http://www.magrama.gob.es/es/alimentacion/temas/la-agricultura ecologica/INFORME_NACIONAL_2011_190912_tcm7-220494.pdf

MAGRAMA. 2013. Ministerio de Agricultura, Alimentación y Medio Ambiente. Integrated Farming survey January 2012. http://www.magrama.gob.es/es/agricultura/estadisticas/superficies_tcm7-287639.pdf

Norwood, F. and Lusk, J.L. (2011). "A Calibrated Auction-Conjoint Valuation Method: Valuing Pork and Eggs Produced under Differing Animal Welfare Conditions" Journal of Environmental Economics and Management 62 (1): 80-94, 2011

Quenum, L. (2010). Tesis Doctoral. Comparación entre la producción ecológica e integrada de hortalizas en basa a parámetros del suelo. Valencia: Universidad Politécnica de Valencia.

Rude, J.I., 2001. Under the green box. The WTO and farm subsidies. Journal of World Trade 35, 1015-1033.

Srinivasan, V. and Park, C. S. (1997). Surprising Robustness of the Self-Explicated Approach to Costumer Preference Structure Measurement. Journal of Marketing Research 34 (2): 286-291.

Willer, H. & Kilcher, L. (2011). The World of Organic Agriculture Statistics and Emerging Trends 2011. IFOAM.